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THE SANITATION OF WATERSHEDS¹

PROF. W. P. MASON: While Mr. Sherrerd was speaking of his watershed of 63 square miles I could but think of the 67 square miles of our own lower service at Troy. It would be very expensive for a city of the size of Troy to do what Newark has done, so we are striving to get along with a cheaper plan. We have to police our watershed as best we can and see to it that nothing very serious happens. A great deal can be done by careful policing. If a local sanitary officer, by preference a local physician, be secured at reasonable expense and be empowered to employ as assistant a man of intelligence who will give his whole time to the work under the direction of the sanitary officer, much can be accomplished.

Pollution from railway trains is a young subject and has by no manner of means been fully studied. I once attempted to secure some information from a railway office as to the number of times the toilet in a car was used per mile of roadbed, but nothing could be learned.

If we had some such record the information would be useful. As matters now stand, the railway companies are expected to so look after their trains that roadbed pollution shall not damage the catchment area of any water supply. Sundry propositions are under discussion, such as locking toilet-room doors while passing points of special danger, or carrying all dejecta in a closed tank to the end of the car's run. But doors cannot always be locked as proposed, and the incipient typhoid cases, who are the most dangerous class of passengers, are the very ones who would make the locking impracticable. Carrying any type of earth closet on a car would almost certainly prove unpopular. To my mind the remedy lies with a sanitary oversight of the roadbed rather than of the rolling stock, and the entire burden of such oversight should not be borne by the railway companies.

R. E. MILLIGAN: I have heard with particular interest Professor Mason's remarks as to the difficulty of handling waste discharges

¹Discussion of papers by Messrs. Sherrerd, Coffin and Breitzke at a meeting of the New York Section on December 20, 1916.

and pollution from railroads crossing watersheds. I suppose that the experience at Scranton, Pennsylvania, is well known to all interested in the subject, and I assume that it was clearly established there that disease was communicated to the reservoirs and passed into the water through lack of prevention on the part of the railway company whose right-of-way crossed the watershed. It is, however, the question of practically eliminating disease through the purification of such waste that appeals to me after listening to Professor Mason's remarks. Those engaged in the purification of water by filtration and sterilization, or both, are well aware of the extreme difficulty of installing practical devices that will perform the work required. There is not, nor can there be, a central point of collection, furnishing the purification plant with any measurable standardized and uniform waste to be handled. I think it would have very little effect to keep men employed in collecting the discharges on the right-of-way after the passage of trains, and would undoubtedly constitute too serious an expense when the number of trains and passengers on such a system as the Pennsylvania Railroad is called to mind.

You probably know that following the standard imposed upon steamship companies traversing the Great Lakes by the federal government, a great deal of money was expended in preventive measures so that the waters of the Great Lakes would not be contaminated through the steamship traffic and that cities taking their supplies from the Great Lakes would, at least, be free from this serious contamination. It is quite true that at the present time no satisfactory method of purification has yet been installed, although very expensive experiments were conducted, and a board appointed to pass on the various methods advocated.

The arrangements on a steamboat do not lend themselves to concentration at any particular point, nor is there any uniform use of water enabling automatic devices to be installed. It would be entirely practicable, of course, to purify a certain quantity of water and store it and have all consumers draw from the purified stored water. This is difficult as steamships are designed, and there is the greatest possible variation in the amount used per minute. Furthermore the Federal authorities impose a condition that all devices shall be absolutely automatic and dependable to no extent upon human supervision.

The purification of the water used on a steamship is governed

by a standard, and I think that Professor Mason himself was one of a committee appointed to prepare and thus responsible for this standard. My observation of this phase of the matter was that it was extremely difficult to get any real interpretation of the standard as it was submitted to the steamship companies, the federal authorities not caring to interpret it and the language of the standard being somewhat ambiguous.

The use for purified water, especially on boats carrying excursions, was at times exceedingly great and eliminated any possible storage within the confines of a steamboat. This same condition is relatively true of the purification of the waste from passengers, as this is also at times of great volume and passes into the waters of the Lakes from many different points. In fact, it would almost seem to be necessary to build a steamboat around purification plants, the one for water and the one for sewage discharges or, perhaps, it would be better to say that it is easier to impose conditions but not nearly so easy to furnish a satisfactory solution of the problems involved.

EDWARD WEGMANN: The speaker is very much interested in the description of the sanitary improvements that have been made in the Croton watershed. Twenty-five years ago the sanitary conditions in this locality were in a deplorable condition. Many out-houses were built right over brooks that flowed into Croton Lake, and heaps of manure were piled on the banks of these streams within a few feet of the water.

In 1892 a great epidemic of cholera occurred in Hamburg, Germany. It was caused by throwing the slops of a sailor sick with cholera into the river Elbe, from which Hamburg obtained its water supply. More than 8000 persons died during this epidemic. In Altona, a suburb of Hamburg, the epidemic did not prevail. This was due to the fact that, while the citizens of Hamburg drank raw river water, the river water was filtered through sand at Altona before it was distributed for domestic consumption. This is one of the strongest proofs we have that disease germs can be removed from water by slow filtration through sand. Great fears were entertained that the epidemic of cholera might spread to New York, and stringent measures were taken to prevent such a calamity. In 1893 an act known as the Webster Law was passed by the state legislature to enable the city of New York to clean up the Croton

watershed. Under this act, which was in force for three years, the commissioner of public works of New York was given great powers. He had authority to remove summarily any source of pollution, even to order people to move out of houses that were thought to endanger the public health and to set fire to them.

The commissioner who was then in office made several sanitary raids in the Croton watershed. He was accompanied by many of his subordinates and by numerous reporters. The weather was very cold at that time, and to prevent any member of the raiding party from getting sick from exposure to the elements, several bottles of some kind of amber liquid were taken along. In fact the commissioner had always one of these bottles in the pocket of his ulster and treated his friends liberally to the contents in order to preclude the possibility of their getting sick. A few sources of pollution were removed and one dirty building was burnt to the ground, after being photographed and measured. After the novelty of these raids wore off, the commissioner delegated all his authority under the Webster act to the division engineers of the aqueduct commission, who were at that time in charge of the construction of reservoirs in the Croton watershed. As one of these division engineers, the speaker had the rather irksome duty of cleaning up about 100 square miles of the Croton watershed. The board of health of the state of New York had established numerous rules for the sanitary protection of watersheds from which public water supplies were obtained. These rules stated even the minimum distance between chicken coops and running streams. While these rules were very good, it was almost impossible to get the law department of the city of New York to enforce them.

From what Mr. Coffin tells us, the sanitary condition of the Croton watershed has been much improved in recent years, and every possible precaution appears to have been taken to prevent the city's water supply from being polluted.

Mr. Sherrerd has explained to us how Newark, New Jersey, is quietly buying up gradually the watershed from which it obtains its main supply of water. Boss Tweed, when he had control of the government of the city of New York, had some thought of buying up the whole Croton watershed, which contains about 350 square miles about the Old Croton Dam. The cost, however, even in those days when the value of land in the watershed was much less than now, was prohibitory. As Boss Tweed is only remembered

now as a corrupt politician, I wish to record here one of his actions which I think was very much to his credit. The late Gen. George S. Greene, who was chief engineer of the Croton aqueduct department when the Tweed ring obtained possession of the city government, told the speaker that Mr. Tweed sent for Benjamin S. Church, the resident engineer in charge of the old Croton aqueduct, and told him that he fully realized the great importance of the proper care of the Croton aqueduct to insure the health of the city of New York, and that he would not permit any political influence to interfere with the management of this great work. Mr. Church was permitted to retain all the assistants who were then employed on this work.

As regards the purchasing of a watershed, it will be in most cases impossible, on account of the great cost that would be involved. The city of Birmingham, England, acquired the watershed from which it derives its main water supply, but in this case the land involved is in the mountains and has little value. Even if a watershed is bought up by the community it supplies, one person who becomes sick with typhoid, or some similar sickness, is likely to cause an epidemic. Professor Mason tells us, in his book on *Water Supply*, that some years ago a workman who had contracted typhoid fever was sick in the mountains of Pennsylvania. It was winter at the time and all the slops from this sick person were thrown on the ground by the attendants. Cold does not destroy typhoid germs, and when warmer weather arrived and the snow melted, the germs got into little rivulets which gradually found their way into a big stream, from which Plymouth, about 20 miles further down stream pumped its water supply. About 1000 cases of typhoid fever resulted from the carelessness of the persons in charge of the sick person up in the mountains.

It seems to the speaker that in most cases it will be a great deal cheaper and safer to construct filters for purifying the water than to buy up a whole watershed and to patrol it. Of course, in the case of Newark, there may be some other object in view, such as creating a state park. As a general proposition, however, the best way to prevent pathogenic diseases from reaching a community is by mechanical or slow sand filtration.

ALEXANDER POTTER: Newark's policy of protecting its water supply by controlling the watershed has proved successful, the city having already purchased about 70 per cent of the Pequannock water-

shed. One cannot consider this problem long without raising the question: If this is proper for Newark, why is it not essential in every other city in the United States? If this question is answered in the affirmative, another question presents itself: Is it the most economic solution of the pure water problem?

In the Pequannock watershed the city of Newark established values which it was willing to pay for lands. Unless it is the only reasonable method of insuring safe water to a municipality the individual should not be asked or required to dispose of his land unwillingly, even admitting that Newark was willing to pay fair market value prices at the time of taking. If the owners would not accept these prices they saw the value of their property gradually depreciated by the destruction of adjoining houses and the elimination of the community value or unearned increment which they either paid for or helped to create. A property owner is not necessarily entitled to the increment in value due to improvements that the city might make, but he is certainly entitled to protection from the depreciation in value sure to follow a systematic program of the city for wholesale purchase of land to be put to such use as would inevitably depreciate adjoining land values.

This whole question is especially pertinent at the present time in view of the fact that Newark, for instance, has in course of preparation plans for the development of an additional watershed, namely, the Wanaque, not alone for Newark but also for other cities willing to join in the expense of its development. If Newark deems its practice in the Pequannock watershed hygienically sound it would naturally pursue the same policy in the Wanaque watershed, and consequently the development of this water supply from the Wanaque, if the same policy be adopted, would logically mean a systematic lowering of land values in this area to the detriment of the owner, either in present values or in future enhancement of value which it was perfectly legitimate for him to look forward to.

If Newark should adopt the same policy of purchase of the watershed of the Wanaque, it means one of two things: first, a vast increase in the cost of the project, if, for instance, anything like the same percentage of area is immediately purchased for the protection of the watershed, or second, if the ownership of this high percentage of the watershed is essential there is a potential danger from pollution until Newark can secure the same percentage of area that it has in the Pequannock watershed.

If it be admitted that the control of such large areas of watershed

ultimately is necessary, its purchase should be consummated not by the continuous process which inevitably reduces values, but by establishing at the present time the fair and just value of such lands in a manner prescribed by law for the acquirement of lands, giving the owners collectively ample opportunity to protect their rights and insist upon the payment of full market value rather than be forced to see the value of their property gradually depreciated and have no recourse against the destruction of values which some of them have labored so hard to create. If the ownership of such lands is deemed essential and the cities requiring them are required to pay for their exact value, which in fairness they should, then other methods, equally safe, of protecting and maintaining a pure supply of water may prove more advantageous and more economical without drawing from the market these vast tracts of splendid highland country which should be utilized, and ultimately will be required, to house the overflow population from nearby cities.

O. J. ORCHARD: I was particularly interested in Mr. Breitzke's remarks in reference to the success of persuasive measures rather than compulsion in securing abatement of nuisance. It was my good fortune at the time Mr. Breitzke began his work on the Jersey City watershed to be connected with the New Jersey state department of health and to have, under Dr. Fitz Randolph, the partial supervision of the inspectors. It was our custom, immediately upon receipt of report of pollution from one of the field men, to issue a formal notice requiring the abatement of the nuisance within ten days. The fact that the Phillipsburg case was then pending in court and had not been settled, placed the state department of health in such a position that these orders could not be enforced. The notices created a spirit of antagonism against our further efforts to secure abatement. The percentage of abatements from notices served was, I believe, somewhat less than 10.

About three years ago the procedure was adopted of sending a friendly letter to the owner of the polluting premises, calling his attention to the pollution; what it meant; the fact that it possibly endangered the lives of innocent persons; and the letter was followed up wherever possible with a personal visit by one of the field men. It is my recollection that the percentage of abatements secured at a far less expense than that involved by serving legal notices was

at least three, and I think fully four, times as large than when the ten-day notice was served.

ALLEN HAZEN: It has been suggested in connection with the pollution of watersheds by trains that the ballast in the railway track was itself an almost ideal sprinkling filter and that the dose is small and very well distributed.

MORRIS R. SHERRERD: Mr. Potter seems to lose sight of the fact that the ultimate purpose of the work the city of Newark is carrying on in its watersheds is not only to protect the consumers of the supply from these areas but also to convert this part of New Jersey into a great park. The latter purpose is no different from the creation of the Inter-State Park and the Palisades Park, for which the land was acquired in the manner followed by Newark.

In treating the Wanaque watershed it is proposed to build a trunk sewer to take care of the cities in the upper region of the river, and it is unlikely that a policy of acquiring land must be adopted here. Furthermore, as some of the cities which contemplate joining with Newark in the Wanaque project are now supplied with filtered water, they will doubtless desire to have the new supply filtered, not only to insure its purity but also its clearness, as their present supplies are clearer than the Wanaque.